Informal Competition and Productivity in Sub-Saharan Africa

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August 2015

Abstract:

Despite the contribution of competition to productivity growth, competition stemmed by informal firms had always been considered as harmful. This paper investigates the significance of such a default hypothesis, by showing the effect of regional informal competition on formal firms productivity in 31 Sub-Saharan African developing countries. Using firm-level World Band enterprise surveys, we update the two- step methodology used by Guiso et *al.* (2004) to build a regional indicator of informal competition intensity. We show that higher intensity of regional informal competition can increase formal firms' labor productivity. This positive effect is segmented by formal firms' size and robust to various checks. Our results call on the importance of economy of scale, and firms' human and financial capital. We also find evidence on the weakness of Sub-Saharan African's business environment that is susceptible to jeopardize any positive effect associated with the informal sector. The paper contributes to the understanding of growth in Sub-Saharan Africa, including informal firm competition as a factor explaining the labor productivity increase in formal firms.

Keywords: Informal competition, labor productivity, formal firms, informal sector, obstacles.
JEL: O17, D22, L25.

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This work was supported by CEPREMAP and UPEC. We would like to thank Asif Mohammed Islam from the World Bank Enterprise Survey Unit for his active collaboration. We would also like to thank Igor Bagayev (ERUDITE- UPEC) and Racha Ramadan (Cairo University) for their useful comments and guidance. Many thanks to Stéphanie Mahieu for her help. All errors remain ours.

1 Introduction

The recent Sub-Saharan African economic growth has opened questions about the role of the informal sector in recent GDP trends. It is in this part of the world where we can find productivity growth coupled with informality growth and persistence. We underline this controversy by investigating the contribution of the informal sector in one of the main driver of economic growth: "market competition". In other words, we test the effect of competition stemmed by informal firms, hereafter "informal competition", on the productivity of formal ones taking into consideration regional and firms' characteristics.

Our motivation is raised from the dilemma of the informal sector. If the informal sector is likely to be considered as a threat, why is it growing considerably, not only in developing countries but also in developed ones? Why these activities are still ignored and discouraged by governments? Is it enough to argue on these questions based on the benefits of the informal sector? Is it enough to say that the informal sector is expanding because it allows people to escape taxation, to avoid business regulation and to have an advantage in cost? In addition, what about the recent "unexplained" African economic growth, described as a "miracle" by Alwyn Young in 2012? Is it appropriate to ascribe this entire economic catch-up to the "pig push theory"? Why does the economic development of African countries open questions about the contribution of the informal sector in recent economic growth (La Porta & Shleifer, 2008a)? This dilemma encourages us to reconsider the effects of the informal sector.

Launched in 1972 by the ILO's report, the concept of "informal sector" was initially presented with a very positive and optimistic view (see ILO, 1972 and E. Bangasser, 2000). As highlighted by this report "*The bulk of employment in the informal sector, far from being only marginally productive, is economically efficient and profit making, though small in scale and limited by simple technologies, little capital and lack of links with the other ('formal') sector*". However, the economic efficiency of the informal sector was hardly acceptable by economic analysts. The most common interpretation characterized the informal sector as a temporary shelter for poor that disappear with economic development. The informal sector viewed as a threat to economic activity became a self-fulfilling prophecy that persisted through time.

By consequences, most of existing studies on the informal sector highlight its main characteristics, compare it to the formal sector and show its negative impact on the overall economy (De Soto, 1990 & 2000; Gardes & Starzec, 2009; Djankov et al., 2004; Galal, 2005; El-Hamidi, 2011; etc). As approved by several economists, informal sector activities are less productive than formal ones and are sometimes unproductive at all. This lowers the overall productivity growth of the economy. Informal firms and self-employed lack access to formal source of finance, to governmental services, to proper documentation and to infrastructures. They tend to employ unskilled and less productive workers and their output is more labor intensive. Based on these facts, it is more logical to assume that everything related to the informal sector is –by default- harmful for the economy. Even the competition stemmed from informal firms, which is the focus of this paper.

Competition is known as the driver of economic growth. It creates strong and efficient markets by keeping the most efficient producers and squeezing out inefficiencies. It also puts a downward pressure on costs and supplies the market with new products or new enterprise organization. However, papers considering "informal competition" have also assumed -by default-, that informal competition is harmful (González & Lamanna, 2007; Friesen and Wacker, 2013). Thus, they have focused on detecting the characteristics of formal firms that make them more exposed to informal competition. To the best of our knowledge, no study has so far tested the significance of this default assumption. This paper aims to fill this gap, by testing empirically the real effect of informal competition.

According to La Porta & Shleifer (2014, p.109) *"In developing countries, informal firms account for up to half of the economic activity. They provide livelihood for billions of people. Yet their role in economic development remains controversial*." We chose to focus on Sub-Saharan Africa, as most of the country of this region are developing countries with low-income levels and very large informal sector. We find this region at the top of informality according to the results of Schneider et *al.* in 2010. More precisely, Charmes (2012)'s analysis of the employment in the informal sector in Sub-Saharan Africa indicated that the peak was reached between 1995 and 1999, with a percentage of 86.9% of non-agriculture informal employment. Then, between 2000 and 2005 the percentage has reached its minimum level, with 63.3% of informal employment. However, the percentage started to increase again and has reached 69.5% between 2005 and 2010. As highlighted by table 1 below, the rates of informal employment in Sub-Saharan African countries are very large and is beyond 60% in some countries as in Côte d'Ivoire, Madagascar, Mali, Tanzania, Uganda and Zambia.

Table 1: Employment in the informal economy in non-agricultural activities

	Person in informal employment	Persons employed in the informal sector	Persons in informal employment outside the informal sector
	% on non-agriculture employment		
Cote d'Ivoire (2008)	n.a.	69.7	n.a.
Ethiopia (2004)	n.a.	41.4	n.a.
Lesotho (2008)	34.9	49.1	21.6
Liberia (2010)	60	49.5	10.8
Madagascar (2005)	73.6	51.8	21.9
Mali (2004)	81.8	71.4	11.3
Mauritius (2009)	n.a.	9.3	n.a.
Namibia (2008)	43.9	n.a.	n.a.
South Africa (2010)	32.7	17.8	14.9
Tanzania (2005/2006)	76.2	51.7	25
Uganda (2010)	69.4	59.8	13.7
Zambia (2008)	69.5	64.6	11.7
Zimbabwe (2004)	51.6	39.6	n.a.

Source: ILO, Department of Statistics; Country responses to ILO data request, special tabulations of labor force survey data, extracts from survey reports. See ILO (2012b)

These figures support the underlined dilemma of the informal sector. That's why we intend to use "informal competition" as a tool to reconsider the economic efficiency of this sector. The importance of this tool has been highlighted in the 2013 World development report and has been reported through the World Bank Enterprise Survey indicators. In Sub Saharan Africa, 67.7% of formal firms compete against informal firms and 38.8% of formal firms perceive the practices of competitors in the informal sector as a major constraint to their current operation. Moreover, informal competition has been ranked as the third most important obstacle to the current operation of formal firms. These numbers are based on the subjective view of formal firms' entrepreneurs towards the practice of competitors in the informal sector[1]. Two reason can explain the underlined bad perception about the informal sector. First, informal competition is generated because of the growing number of informal firms that are initially considered as a threat. Second, informal firms have an advantage in cost (since they are avoiding registration costs and taxes) that allow them to undercut the prices and, to therefore, cause a sort of unfair competition.

In this paper, we consider the considerable growth of the informal sector and the importance of informal competition as our main hypothesis. We investigate to which extend the competition stemmed by the growing number of informal firms[2] affects the productivity of formal ones. Our analysis is based on a pooled sample of 14437 formal private firms extracted from the Standardized Enterprise Surveys[3] collected by the World Bank over the period 2006-2013 in 31 Sub-Saharan African and developing countries[4]. These countries have a homogeneous economic development pattern, in terms of prevalence of poverty, informality, governance, corruption, supply of infrastructure and business environment. This homogeneity allow us to have an interesting cross-country analysis. In addition, a regional analysis of informal competition's prevalence can be done because of the availability of regional data on this set of countries.

To begin our analysis, we assume the following hypothesis: informal firms are growing fast and constitute the first source of revenue for poor. Informal firms are able to compete against formal firms especially those operating in the same market and serving the same type of consumers. The effect of informal competition persists more locally (or regionally) than nationally or internationally. Weak governance and business environment in sub-Saharan Africa prevents the realization of an effective competitive process. Finally, the informal sector can be considered as an economic resource rather than a threat.

[1] These indicators are based on 3 questions: Does this establishment compete against unregistered firms? To what degree are practices of competitors on the informal sector an obstacle to the current operation of this establishment? Which elements of the business environment included in the list, if any, currently represents the biggest obstacle faced by this establishment?

[2] In our sense, informal firms are those firms who fail to comply with economic regulation (registering and licensing) and who fail to meet their tax obligations (ILO, 2009). They also refer to micro firms (with less than 5 employees) and self-employment.

[3] Enterprise Surveys (http://www.enterprisesurveys.org), The World Bank.

[4] See appendix 1 for a full list of countries included in the sample.

Our benchmark specification consists of estimating the effect of informal competition on formal firms' productivity. Two approaches can explain this specification. The first is the causality approach since informal competition can have a direct effect on formal firms' productivity and vice versa. The second is the omitted variable approach since both variables can be driven by the propensity of informal firms to cut off the prices because of their cost advantage generated by not paying taxes and by not applying with any regulation and law.

To solve for these econometrics issues, we estimate our benchmark specification via two steps. The first step involves the construction of a regional indicator of informal competition intensity using the updated two-step method of Guiso et *al.* (2004). Since the intensity of informal competition is reflected in the dataset only through a perception variable[5], the construction of an indicator allow us to prevent any biasness linked to the direct inclusion of this perception variable in our benchmark specification. Then, it shows us the level of informal competition intensity in each region of the sample. Based on this indicator we can implement interesting cross-country and cross-region analysis.

Through the second step, we estimate our benchmark specification using a simple ordinary least square estimation. We involve in this estimation, sector, country and years fixed effects to reduce the number of variables that we rely on, as well as the range of possible alternative explanations. Therefore, this two-step methodology allow us to be less subject to criticism about an omitted variable bias or model specification. We also present three robustness checks test to test the validity of our results.

As we have expected, our first step estimation shows that formal firms' probability of judging less severely the intensity of obstacles due to the practices of competitors in the informal sector decreases when formal firms grow in size. This negative relationship holds with more stable business environment and when registering procedures are alleviated. Our findings also confirm our baseline hypothesis assuming that the effect of informal competition must be analyzed regionally rather than nationally.

The main contribution of this paper is manifested through our second step that estimates the effect of regional informal competition intensity on formal firms' productivity. We find that the higher is the regional informal competition intensity, the higher is formal firms' labor productivity. In other words, more intense competition stemmed by informal enterprises drives formal firms to be more productive. This result show that informal competition could be productive and that the default hypothesis of assuming the informal sector as harmful must be revisited. Moreover, our robustness checks tests confirm the validity of this positive effect.

Our results show that this positive effect is segmented by formal firms' size, as large and very productive formal firm are already protected. Many elements allow formal firms to benefit more effectively the positive effect of informal competition. Formal firms become more productive and competitive by creating economy of scale, acquiring stronger human and financial capital and by

[5] *Do you think that the practices of competitors in the informal sector are an obstacle to the current operations of this establishment?* (see section 4.B for the construction of the indicator)

enhancing the expertise of the firm and its managerial capacity. We also confirm that undertaken policies to enhance the business environment of formal firms are repressive policies for the informal sector. Therefore, these policies are susceptible to jeopardize any positive effects linked to the informal sector, even if they are ineffectively undertaken.

Our paper contributes to the existing literature in different ways. First, we provide, for the first time, empirical estimates on the effect of informal competition on formal firms' productivity by introducing a regional indicator of informal competition intensity. We extend our estimation to a large sample of Sub-Saharan African countries. Second, we emphasize a new type of competition that must be considered more effectively because of the growing number of informal firms in developing world. Third, we adopt existing econometrics technics to introduce nonlinear effects that could explain more extensively the business environment associated with informal competition. Fourth, our results add to the African growth literature by indicating the mechanism through which the informal sector can be considered as an economic resource rather than a threat.

This paper proceeds as follows. We start by presenting the relevant literature review and channels of transmission in section 2. Then section 3 describes the dataset, the variables employed in our regressions and the related stylized facts. We explain the methodology used as well as the indicator construction in section 4. The benchmark results and robustness checks are presented in Section 5. Finally, section 6 indicate the business environment associated with informal competition and the last section summarizes our conclusion and remarks.

2 Literature review:

2.A Theoretical and empirical background

Historically, the relationship between formal and informal firms has been analyzed through different schools of thoughts. According to the Dualist School, the informal and formal sector coexist but are very different by nature. While Formal firms contribute to economic growth, informal firms act as a shelter for poor (Hart, 1973; ILO, 1972). Some other expect that informal firms disappear with economic development and that the surplus of labor is absorbed by the more productive formal sector in the long term (Lewis, 1954; Harris & Todaro, 1970; Rauch, 1991; etc.). Other views presume a more persistent and dangerous dual market because of the imbalances of the overall economy (Singer, 1970).

According to the Structuralist School, the informal sector is linked by nature to the formal sector. Informal firms are subordinated to formal and larger firms and allow them to reduce costs and increase competitiveness. From the Legalist School's point of view, informal firms choose to be informal to avoid the burden of taxes and regulations (De Soto, 1990 & 2000). They are not considered as a threat for formal firms since they are willing to formalize if the government provide them property rights and alleviate registration procedures. In contrast, the Voluntarist School considers informal firms as a threat because they intentionally choose to be informal and are not willing to formalize. As explained

by the Mckinsey Global Institute, these firms cause unfair competition and are able to inefficiently take market shares from more productive formal firms.

Considering this historical background, the idea and the hypothesis considered in our paper paper are based on the results of three more recent papers. These papers focus more in depth on the contribution of the informal sector and on the concept of informal competition. The first paper is the one of La Porta & Shleifer (2008a) who have searched for the relationship between the informal sector and the economic development. Their analysis was based on the three sets of the World Bank Enterprise Survey: the Enterprise survey, Informal survey and Micro survey. Focusing on multiple African, Asian and Latin American countries, they showed that the stylized facts of unofficial firms tend to follows the Dual economic view. As the economy grow, unofficial firms rather die than register since their inefficiency prevent them from complying with government regulations. They failed to find a clear conclusion on the contribution of the informal sector to economic development. However, they pointed out that productivity growth comes from formal firms, especially larger ones.

The two other papers are the only papers that have highlighted the question of informal competition. Both papers used the firm level World Bank Enterprise Surveys[6]. The paper of González & Lamanna (2007) studies the characteristics of formal firms that make them more subject to the practices of competitors in the informal sector in 14 Latin American countries. Then, they examine the business environment associated with intense informal competition. Using a probit regression model, they proved that formal and informal firms compete between each other and are not in segmented or separated markets as suggested by the Dual economic view. Their main result show that formal firms most resembling informal ones are the most adversely affected by informal competition. These formal firms are usually small, credit constrained, operate in industries with low entry cost and serve the same type of consumers as informal firms. They also concluded that informal competition is a threat, especially in countries with low government capacity and high regulation.

The paper of Friesen and Wacker (2013) investigates the relationship between the access to source of finance by formal firms and informal competition in 114 developing and transition countries over the period 2006 to 2011. They build their analysis on the results of Gonzales & Lamanna (2007) by assuming the existence of informal competition that threaten formal firms' operation. Using a non-linear ordered response model, they show that more financially constrained formal firms are more subject to the practices of competitors in the informal sector. They also conclude that the financial constraint is the first determinant of the severity of informal competition. This last is also affected by other variables, such as corruption, labor regulation and firm size.

As already mentioned, there is a lack of literature tackling the effect of informal competition on firms' productivity. However, many studies emphasize the effects of competition in general. Most of these studies conclude that the effect of competition on firms' productivity is positive (Nickell, 1996; Nickell et *al.* 1997; OECD, 2009; Ospina & Schiffbauer, 2010; etc.). Other argue that this positive effect holds

[6] To the best of our knowledge, it is the only survey that provides information about the effect of the practices generated by the informal sector in many countries.

even when it is altered with endogenous and exogenous elements. Two major elements have been tackled more in depth in the literature. The importance of firms' access to finance (Ayyagari et *al.* 2008) and the provision of good business environment and sound infrastructure (Bastos & Nasir, 2004 and Alby et *al.*, 2012).

In fact, the article of Beck et *al.* (2005) has opened the door for many researcher to study the importance of the financial constraint. They showed, in this paper, to which extent the development of the financial sector contributes to poverty reduction by supporting the growth of MSE in developing countries. Similarly, Cull and Xu (2005), Beck and Demirguc-Kunt (2006) emphasized that the financing obstacles are more growth-constraining for small firms and they prevent all firms from reaching their optimal size.

More recently, The World Development Report (2013) and Kuntchev et *al.*, (2014) reported the access to finance as the most powerful constraint hindering firm growth in developing countries, and especially in Africa. They also found that the probability of a firm of being credit constraint decreases with firm size, with higher productivity and with higher levels of private credits to GDP in the country. Other studies have investigated the link between business environment and the financial constraint, as done by Friesen and Wacker (2013). For example, Demirguc-Kunt & Maksimovic (1998) prove that firms in countries with higher rates of compliance to law, have better access to external funds. In addition, the paper of Safavian & Wimpey (2007) found a negative relationship between the quality of regulatory environment and the probability of preferring informal finance. When cost of complying with government regulation is high, firm prefer to avoid the radar of screen regulation.

A large body of literature underlines the critical role of business environment's characteristics in determining the strength of the competition process in any market. A good business environment must ensure the effectiveness of regulation and law, the fluidity of the financial system and the availability of sound infrastructure. Such environment helps the competition process to generate its intended positive effects. However, this is not the case in most of Sub-Saharan African countries. As reported by the World Bank Doing business indicators and the 2015 CPIA Africa report, these countries suffer from weak regulatory framework and law enforcement, the persistence of corruption, the poor provision of infrastructure and the hard access to external source of finance.

As showed by Eifert et *al.* (2005) and Ayagari et *al.*, (2008), these issues have a direct effect on firms' productivity in Africa where reforms must be undertaken to improve firms' competitiveness and diversification. In addition, Djankov et *al.* (2002) proved that heavier regulation increases the intensity of corruption and the size of the informal sector in a wide range of income level countries (out of 85 countries, 14 were African countries). Gonzales et *al.* (2007) showed that African firms are three times more likely to be asked for bribes compared to Latin America firms.

2.B Channel of transmissions:

As we can remark, our three-benchmark papers highlight the inefficiency of informal firms and the threats associated with informal competition. So, how would the intensity of informal competition affect the productivity of formal ones? In fact, several channels could explain this relationship.

The first channel recall the main causes of informality (Schneider et *al.,* 2010). The growth of the informal sector is the result of the burden associated with tax system, social security schemes and severity of labor regulation. This burden induce formal firms to participate in the informal sector by underreporting revenues, labor and outputs. It also encourage new entrepreneurs to start their business informally. The larger is the size of the informal sector, the lower are the tax revenues. This, in turn, causes the reduction of public service provision and the increase of tax rates. Therefore, the incentive to join the informal sector become stronger. This vicious cycle creates a sort of reallocation of resources in labor in the direction of the informal sector. This process allow informal enterprises to be relatively more powerful and more competitive. Hence, they can exert a competitive pressure on formal firms that exist within the limits of the sector in which they operate and compete.

The second channel recalls the characteristics of informal firms. Competition for informal firms is mainly based on creativity because efficiency is very challenging for them due to economy of scale issues. In their case, creativity is not in terms of new technologies but it is rather in terms of adopting new managerial practices. As informal firms are small and usually managed by a single person, they have easier communication strategies and more flexible production process. They are able to move where there is the demand and to serve the market with new services. They are also able to adopt more easily their labor organization and within-firm management to different market shocks (Saviotti and Pyka, 2008; Gülbiten and Taymaz., 2000; Duchêne and Rusin, 2002).

The third and last channel is based on the fact that informal firms have a cost advantage comparing to formal ones since they are less regulated, less taxed and are not complying with any competition law. This cost advantage is considered as a positive force allowing informal firms to operate more efficiently (Schneider & Enste, 2000). Hence, even if informal firms are less productive than formal ones and use inefficient production technics, the higher is the differential in cost between formal and informal firms; the better is the ability of informal firms to take market shares from bigger and more productive firms (La Porta & Shleifer, 2008a).

According to these channels of transmission, informal firms can exert a competitive pressure on formal ones by three means: the growth of the informal sector, the managerial capacity of informal firms and their cost advantage. To econometrically consider these channels, we account in our regressions for the elements that formal firms will use to respond to this competitive pressure. The capacity of formal firms to create economy of scale based on innovation and efficiency is susceptible to hinder informal firms' competitive pressure. Their ability to adopt new technologies and to accumulate human capital can overstep informal firms' managerial innovation capacity. Similarly, their access to external source of finance allow them to create stronger financial capital that overcome informal firms' cost advantage. Therefore, we include in our benchmark regressions variables that represent the size of formal firms, their human and financial capitals and for the sectors in which they operate. We also account, in other regressions, for the business environment associated with the existence of informal competition.

3 Data and stylized facts:

This paper is based on the firm level " World Bank Enterprise surveys (WBES)" conducted by the World Bank and its partners in many developing and transition countries since 2002[7]. The surveys are administrated to a representative sample of firms in the non-agricultural formal private economy and include small, medium and large enterprises in the manufacturing sector, the service sector and the transportation and construction sectors. The sample design of the WBES is stratified random sampling. Three levels of stratifications are used: sector of activity, size and location. Enterprises with less than 5 employees and fully government owned are excluded from the survey. This sampling methodology generates sample size appropriate to benchmark the business environment of each economy from the perspective of the firm, using face-to-face interviews with owner or the manager of the firm.

The topics covered in the WBES include infrastructure, trade, access to finance, regulation & taxes, corruption, crime, informality, labor & firm's performance, and perception about obstacles to doing business. These topics are tackled using qualitative and quantitative questions. Responses provide insights into a firm's objective facts (total annual sales, number of workers, etc.) and subjective perceptions (severity degree of corruption practices, access to finance, number of days to get business license, etc.) about business activities and constraints. Thus, the WBES collects useful information that allow policy makers and researchers to link a country's business climate with firms' performance, and to compare their outcomes within and across countries. These data have been exploited under different scopes to draw useful conclusions and policy recommendations in developing countries about multiple topics. Most relevant studies tackled the measures of productivity (Amin, 2011; Saliola & Seker, 2011; etc.), firms' access to finance and infrastructure (Safavian & Wimpey, 2007; Ayyagari et *al.* 2008; Kuntchev et *al.*, 2014; etc.), incidence of corruption (Gonzalez et *al.*, 2007; etc.), and the effects of regulation and taxes (Sharma, 2009; Amin, 2009; etc.).

In this paper, we use the Standardized WBES that employs a uniform sampling methodology to minimize measurement error and to yield data that are comparable across the world's economies. Our pooled sample period covers 2006 to 2013[8] and accounts for 14437 formal private firms from 31 African and developing countries[9]. There are 13 sectors of activity and 116 regions corresponding to the 31 countries included in the analysis[10]. Among these countries, 15 are low-income countries, 11 are lower middle-income countries and 5 are upper-middle income countries[11]. Ten countries were

[7] The data are available and downloadable through the World Bank portal: http://www.enterprisesurveys.org
[8] Surveys are conducted in each country at different points of time: 2006, 2007, 2009, 2010, 2011 and 2013.
[9] See appendix 1 for a detailed list of countries, regions and years included in the sample.
[10] Although firm level surveys are very useful, non-response are common challenge that mainly occurs with sensitive questions. The questions addressing the perception of formal firms towards the practices of competitors in the informal sector was not answered for 363 observations. After examining these cases, we did not detect any distinctive features with respect to countries, sectors, location, size and ownership, and therefore rule out any selection bias.
[11] World Bank Classification- July 2014

surveyed twice during the time period and one country was surveyed three times. For these countries, we include all surveys in our analysis to maximize the number of observations[12].

The underlined characteristics make the Standardized WBES ideal for the purpose of this study. First, its methodology generates optimized data for the type of cross-country comparison employed in our paper. Second, this survey provides unique information about the degree of informal competition, comparable across all regions included in the simple. Therefore, it allow us to perform a regional analysis on the prevalence of informal competition by constructing a regional indicator of informal competition intensity. Third, the standardized WBES covers, not only medium and large enterprises, but also small enterprises, that are crucial in investigating the incidence of informal competition on the productivity of formal firms.

3. A Dependent variable:

There are many different measures of firms' productivity, all of them having their own strengths and weaknesses. The choice between them depends on the purpose of productivity measurement, but in many cases, on data availability. In our case, we use a single factor productivity measure –firms' level labor productivity- since data on capital are available only for a very limited number of firms in our sample. Therefore, we use total factor productivity measure as robustness check.

In fact, labor productivity has been used as a common indicator in multiple studies tackling firm-level performance in developing countries due to the unavailability of a homogenous data source and to avoid error of measurement resulting from the computation of the denominator (Isaksson et *al.*, 2005; Isaksson, 2007; Kinda et *al.*, 2011, etc.). The measure of TFP requires information about labor, capital and output that are fully available only in individual survey (country-level survey)[13]. However, for the purpose of this research, we chose to use the standardized WBES that presents homogenous data in multiple Sub-Saharan African countries.

According to the following equation, for each firm *i* in country *j*, the logarithm of annual labor productivity will be the ratio of last fiscal year total sales revenues to last fiscal year total full time permanent, temporary and seasonal workers (Temporary and seasonal workers are weighted by their Average length of employment during the year). The amount of last fiscal year total sales revenues was reported in national currency units, which we converted into international dollar using the period average official exchange rates.[14]

$$logprod_{ij} = \log \frac{total\ sales\ revenue\ of\ last\ fiscal\ year_{ij}}{total\ last\ fiscal\ year\ full\ time\ workers_{ij}} \quad (1)$$

[12] Due to the absence of firms interviewed twice in the standardized WBES, we do not use a panel analysis.
[13] To find this information, one must use country-level WBES instead of the standardized WBES as done in Ospina & Schiffbauer (2010) and Saliola & Seker (2011), who also encountered some issues in finding all the required homogenous data.
[14] Made available through the World Development Indicators and the International Monetary Fund

Where,

$$Total\ last\ fiscal\ year\ full\ time\ workers_{ij} = last\ fiscal\ year\ total\ full\ time\ permanent\ workers_{ij} + last\ fiscal\ year\ total\ full\ time\ temporary\ and\ seasonal\ workers_{ij} * average\ lenght\ of\ employment / 12$$

A common criticism could be addressed about the credibility of sales data generated from micro- level surveys. Some firms do not record their daily operation, and in many cases, reluctant respondents tend to underreport this kind of information. However, controlling this issue is hardly applicable. Therefore, to keep most credible data, we exclude firms with very large sales (firms having sales in US$ three standard deviations away from the mean value), as well as firms with labor productivity values at the extreme 5% distribution tail[15]. Remaining data can be trustful especially that the WBES implementation note underline the following: "*The enumerator should make special efforts to assist respondents to provide figures for these sections… assuring respondents of the confidentiality of their information and the potential value to the enterprise of reform recommendations may induce reluctant participants to provide this sensitive information.*" Also, enumerators are asked to confirm the accuracy of this information at some point in the interview[16].

As highlighted in appendix 2, the average annual labor productivity of firms included in the sample is 7823.224US$, corresponding to an average annual total full time workers of 29 workers and an average annual total sales revenues of 151462.3 US$. The chemicals and pharmaceuticals industry shows the highest levels of average annual labor productivity followed by the retail and wholesale industry and the leather industry. The average annual labor productivity is indeed higher for older firms, having managers with stronger experience and favoring partnerships, which reflects a more secured human and financial capital for the firm.

3. B Independent variables:

As we have already mentioned, the purpose of this paper is to estimate the effect of competition stemmed by informal or unregistered firms on the productivity of formal ones in multiple Sub-Saharan African developing countries. Therefore, variable reflecting informal competition intensity will be our independent variable of interest. The only way the Standardized WBES presents this variable is by the following question:

Do you think that the practices of competitors in the informal sector are No Obstacle, a Minor Obstacle, a moderate obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?

We transform this question to a dummy variable that indicates whether or not the owner of firm *i* perceives the practices of competitors in the informal sector as a moderate, major or very severe

[15] In total about 4239 Firms were identified as outliers.
[16] Information provided by enumerators will be used in our robustness checks to test the validity of our results)

constraint to the daily operation of his/her firm[17]. Although perception variables could be very insightful, their direct inclusion in the model may bias the results because of over-reporting or underreporting behaviors[18]. That is why this perception variable will be used to construct a regional indicator of informal competition intensity that varies across regions of each country specified in the sample. The construction of the indicator is explained in the next section (4.B).

According to our sample (appendix 2, m-n), the practices of competitors in the informal sector is considered as the third most important binding constraint faced by formal firms after the access to finance and electricity. Our data show that 54% of formal firms perceive the practices of competitors in the informal sector as a binding constraint. Those firms are eventually smaller with a sole proprietorship legal status. While the least affected are concentrated in the chemical and pharmaceutical industry, those firms are concentrated in the wood and furniture industry. They also perceive the access to finance & electricity and the severity of corruption & taxes as their main obstacles hindering them from operating in a good business environment.

Other explanatory variables are employed in our model to control for the main characteristics of the firm and its owner, as well as for the main obstacles faced by the firm. As we already mentioned, our econometric specification consists of two steps. Dummies for firms' size, sector of activity, firm's age and interview's year are the only common variables included in both steps. In the first step, we focus on involving explanatory variables that explains the business environment's characteristics that might explain firms' perception on the intensity of informal competition constraint. We, thus, account for the obstacles faced by formal firms due to crime risks, tax rates, licensing procedures and corruption practices. Similarly, we include in the second step other obstacles related to the firm' access to different source of finance. We also account for firms and owners' characteristics, such as the legal status of the firm and its manager experience in the sector. All these explanatory variables were chosen according to the context of the paper and to data availability. The following paragraphs present more in details the characteristics of these variables.

The **size** of the firm is presented by the number of full time temporary and permanent employees of the firm. It is also employed in our second step regression as a discrete variable that equals 1 if the firm is small (firms with 5- 19 employees), 2 if the firm is medium (firms with 20-99 employees) and 3 if it's large (firms with more than 100 employees). The importance of firm size has been highlighted in different contexts (Beck & Demirguc-Kunt, 2006; Gollin, 2008; Amin, 2011; etc.). According to the context of our paper, La Porta & shleifer (2008a) have concluded that informal firms are small and unproductive comparing with even small formal firms. Moreover, González & Lamanna (2007), showed that formal firms affected by direct competition from informal firms are those who resemble

[17] As highlighted by the WBES note, the Competition from unregistered or informal firms measures the establishment's perception that it may be competing with firms that may be smuggling, not abiding by copyrights or other intellectual property restrictions, avoiding payment of taxes or duty, producing and/or selling counterfeit items, and/or skirting regulations or other measures prescribed by law.

[18] In the context of our study, formal firms will be more motivated to over-report their answers in order to blame the business climate for the existence of informal firms.

informal firms the most. They are small, they operate in the same sector of activity and they serve the same type of consumers.

The data cover all the 2 digit **manufacturing industries** according to the international standard industrial classifications (ISIC, revision 3.1) such as; textiles, leather, garments, food, metals and machinery, electronics, chemicals and pharmaceuticals, wood and furniture, non-metallic and plastic materials, other manufacturing, retail and wholesale trade, hotels and restaurants and other services[19]. As reported in Appendix (2, i-k) the data show that the majority of firms are small and medium-sized (70% and 25% of the sample respectively), working in the retail and wholesale trade sector (26% of the sample), in the manufacturing sector (12.54% of the sample) and in the food sector (12% of the sector). This mirrors the fact that the business environment in Africa is mainly composed of small and medium enterprises (SMEs) and manifests a fast growth of self-employment. That is why we remark that 61% of firms in the sample operate as sole proprietorship and only 16.7% of firms have a partnership or a limited partnership status.

Considering the **legal status** of the firm, firms in our sample are categorized as publicly or privately held company, sole proprietorship, partnership and limited partnership. As firms in developing countries are not in favor of having partners, sole proprietorship is the most common legal form in these countries. This form allows them to deal with more simple licensing procedures, regulations and taxes. However, having more partners and investors might be beneficial for the firm in terms of access to finance and when dealing with informal competitors.

The **age of the firm** is measured by the log difference between the year of the interview and the year the firm began operation (plus one). It is hard to expect the effect of firms' age on the productivity of the firm in the presence of competitors form the informal sector. Older and more productive firms might be more aware of the functioning of the market, which make them less sensitive to the practices of informal firms. Younger firms might be more innovative and more flexible in dealing with markets' shocks, which allow them to respond more wisely to the practices of informal competitors.

Yet, the standardized WBES lacks homogenous data on managers' characteristics, such as his/her age, gender, educational level, marital status, etc. That is why we account for these characteristics based on the **manager experience in the sector**, which can be used as a proxy to account for his human capital. As the education system is very poor in SSA, it is much more relevant and efficient to account for a firm's human capital based on learning by doing than on conventional education. We expect that, the accumulation of experience creates a market-specific knowledge that allows the manager to operate more efficiently. We can also expect that more experienced managers run bigger and older firms, hence more competitive firms.

The average firm's age is 13 years and the average manager's years of experience is 12.6 years. Since the accumulation of human capital is the main driving force of observed earnings but it rises at a diminishing rate throughout one's life (Mincer, 1974), we find that firms run by managers below the

[19] Some manufactures are combined to achieve a sufficiently large number of observations such as auto & auto components with other manufacturing.

average manager's years of experience have almost the same average labor productivity of those run by managers above the average manager's years of experience. This means that older firms are bigger and are run by more experienced managers, but might be as productive as younger and smaller firms.

The last set of explanatory variables control for the different obstacles faced by firms such as the **access to finance, the severity of licensing procedures, taxes, corruption and crime**. The separate effect of each of these dummy variables have been the focus of many studies that was based on firm-level datasets. In instance, Islam (2014) found that crime against firms –especially small and medium firms- affects negatively economic growth. Djankov et *al.* (2002) showed that more intense regulation of entry affects positively the intensity of corruption practices and the size of the informal sector. Olken & Pande (2012) indicated that corruption has a direct and indirect negative effect on firms' decision and behaviors. Our data show that about half of our sample consider tax rates and corruption practices as moderate, major or very severe obstacles to the daily operation of the firm. Almost 40% of firms consider licensing procedures and crime risks as binding constraints. These barriers to entry are one of the main reasons forcing firms to operate informally and to think about creating resources without respecting the related regulation and rules. That is why, self-employment and the informal sector is becoming the norm in developing countries.

In 2013, The World Development Report has reported the **access to finance** as the most important binding constraints affecting the daily operation of firms in developing countries. That is why we use two different dummy variables to reflect this kind of obstacle. The first takes one if the firm has a checking or saving account, and the second takes one if the firm has a credit or loan. Similarly, our data show that although 83% of the firms have a checking or saving account, 64% of the firms perceive the access to finance as a binding constraint. Especially that only 15% of firms have a line of credit or loan from a financial institution.

Accounting for the importance of these stylized facts, we found it appropriate to investigate the socio-economic impacts resulting from the practices of competitors in the informal sector. Our conclusion are built on the analysis of the formal private sector that remains one of the pillar of any economy and the most common effective and equilibrium state that any government wish to reach.

4 Methodology:

This section presents the econometric specification used to estimate the effect of informal competition on formal firms' labor productivity via two steps. The first step involves the construction of a regional indicator of informal competition intensity using the updated two-step method of Guiso et *al.* (2004). Then, in the second step, we estimate our benchmark specification using a simple ordinary least square estimation (OLS). We also introduce different nonlinear effects to examine the business environment associated with informal competition.

4. A Benchmark specification:

In order to estimate the effect of the intensity of regional informal practices on the labor productivity of formal firms, an OLS estimation is used. Our initial equation takes the following form:

$$lprod_{ij} = \beta_0 + \beta_1 IRIC_{ikj} + \beta_2 Z + \alpha_t + \alpha_s + \alpha_c + \varepsilon_{ij} \qquad (2)$$

Where $lprod_{ij}$ is the logged annual labor productivity of the formal firm *i* of country *j* in US $. $IRIC_{ikj}$ is the constructed indicator of regional informal competition intensity that varies across firms *i* operating in regions *k* of country *j*. Z is the set of control variables including firm control variables such as the size of the firm, its age, its legal status, the characteristics of the owner and the different obstacle faced by the firm. We also control for unobserved year-specific (α_t), industry-specific (α_s) and country-specific (α_c) factors that might affect our dependent variable.

The OLS estimation unable us to solve for the endogeneity problem. This last occurs because of the causal relationship existing between the intensity of regional informal competition perceived by each formal firm and their labor productivity. However, this issue might be partly eliminated by the use of our constructed local indicator of informal competition intensity that differs across the regions of each country and that remains constant when comparing firms located in the same region. Thus, we can assume that the intensity of informal competition in region *k* do not affect directly the productivity of formal firms *i* located in region *k*. In addition, by taking region, sector and country indicators, we reduce the number of variables that we rely on, as well as the range of possible alternative explanations. Therefore, these methods allow us to be less subject to criticism about an omitted variable bias or model specification.

4.B Indicator construction:

Our baseline hypothesis assumes that the competition stemmed from informal firms has a local effect rather than a national effect, because informal firms are less susceptible to operate, to compete and to supply the market nationally and much less internationally. The intensity of informal competition is reported by the WBES through subjective variable that depend on the perception of formal firms' manager toward the degree of informal competition. That is why, creating a regional indicator of informal competition will be more insightful and will avoid any biasness linked to the direct usage of perception variables.

To do so we update the two-step method developed by Guiso et *al.* (2004)[20] who estimated a regional indicator of financial development in Italy. Based on this methodology, we create an Indicator of Regional Informal Competition Intensity (hereafter IRIC). We do so using firm-level perception variables and subjective assessment of factors that affect the intensity of informal competition

[20] Guiso et *al.* (2004)'s paper studied the effect of differences in local financial development within an integrated financial market by estimating a regional effect on the probability that a household is shut off from credit market. This methodology was also used in Bagayev and Najman (2014) and Villegas-Sanchez (2009).

perceived by formal firms in each region. In the standardized WBES, the intensity of informal competition is reflected through the question highlighted below:

> *Do you think that the practices of competitors in the informal sector are No Obstacle, a Minor Obstacle, a moderate obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?*

As a first step, this question is employed in our specification as a dummy dependent variable that takes one if the formal firm perceive the practices of competitors in the informal sector as moderate, major or very severe obstacle and zero if they perceive it as no obstacle or minor obstacle. Since our dependent variable is binary, the linear regression framework will be inappropriate and can lead to incorrect conclusion. We therefore adopt a probit regression to estimate the following equations:

$$Perceive_{ij} = \alpha_0 + \alpha_1 X_i + \delta \boldsymbol{Region}_k + D_s + D_t + \epsilon_{it} \qquad (3)$$

Where $Perceive_{ij}$ is a dummy variable that takes 1 if the formal firm *i* of coutry *j* perceives the practices of competitors in the informal sector as a binding constraint and zero otherwise. X_i is the vector of firm-specific attributes that might explain firms' responses and includes variables measuring the severity of tax rates, of licensing procedures, of corruption, and crime risks. $\boldsymbol{Region}_k$ is the set of regional dummies that will be used to construct our regional indicator of informal competition. Our reference region is Jinja in Uganda that shows the higher number of formal enterprises perceiving informal competition as a binding constraint. We also include industry dummies (D_s) and year dummies (D_t) to control for the unobserved factors that might affect our dependent variable.

Our sample covers 116 regions of 31 Sub-Saharan African countries. The average number of enterprises per region is 124 enterprises. To note that, countries with less than two regions as well as regions with less than 20 enterprises have been excluded from our econometric estimation to prevent any bias resulting from undersized countries or regions. On average per region, around 65 formal firms perceive practices of competitors in the informal sector as a binding constraint.

As expected, the results of the first step probit estimation in table 2 show that the probability that formal firms perceive informal competition less severely increases when formal firms grow in size and when the obstacles related to crime risks, tax rates, licensing procedures and corruption practices are alleviated. These first results confirm the findings of our benchmark papers. They also add to the wide literature that covers the relationship between business environment and informality.

Our variable of interest is $\boldsymbol{Region}_k$. The measure of regional informal competition will be provided by the coefficient δ in region *k*. If informal competition do not matter in a given region, then the coefficient associated to this region will not be significant. This is the case of 7 regions, in which the probability of reporting informal competition as binding constraint is not significantly different than in our reference region[21]. All other regions report negative and significant coefficients. Hence,

[21] For these regions, we choose to keep a measure for IRIC rather than dropping them, since it does not affect our final results.

comparing to firms included in our reference region (where there is the highest intensity of informal competition), firms in all other regions report a lower probability of informal competition intensity.

Table 2: First step estimation of IRIC- Probit estimation

Independent variables	Dependent variable: Do you think that the practices of competitors in the informal sector is an obstacle to the operation of this firm?
Labor	-0.000679*** (0.00)
Firm's age	0.00104 (0.00)
Tax rates as a binding constraint	0.230*** (0.03)
Licensing procedures as a binding constraint	0.281*** (0.03)
Corruption as a binding constraint	0.266*** (0.03)
Crime as a binding constraint	0.426*** (0.03)
Region dummies	Yes
Year dummies	Yes
Industry dummies	Yes
Constant	0.435** (0.18)
Observations	12,914
Pseudo R2	0.1295
Level of se clustering	Country- sector

Notes: Dependent variable is the probability that firms perceive the practices of competitors in the informal sector as a binding constraint. It is a dummy variable that takes one if formal firms perceive the practices of competitors in the informal sector as a binding constraint and zero otherwise. Labor is the number of full time permanent and temporary employees in the firm. Firm age is the difference between the date of the interview and the date the firm began operation (plus one). Tax rate, licensing, corruption and crime are dummy variables that take one if the firm perceives tax rates/licensing procedures/corruption practices/crime as binding constraints and zero otherwise. Region dummies are a set of dummies for each separate region included in the survey. The reference region is Jinja in Uganda. Year dummies are a set of dummies indicating the year in which the survey was conducted in each country. The reference year is 2007. Industry dummies are a set of dummies for each industry included in the survey. The reference industry is retail and wholesale trade. Standard errors are robust and clustered at the country-sector. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

The second step of this method consists in providing the measures of informal competition intensity by the ranking of the coefficients δ of the regional dummies included in our probit estimation as reported in column 3 of table 3 in the next section. We then transform these measures to our indicator IRIC by normalizing these coefficients as following:

$$IRIC_k = 1 - \frac{\delta_k}{\min(\delta_k)} \qquad (4)$$

With $IRICI_k$ the regional indicator of perceiving informal competition as binding constraint in region k, δ_k the coefficients of the region dummy in country k. This normalized measure creates an indicator varying between zero and one. Zero for the region less affected by informal competition intensity and 1 for the region most affected by informal competition intensity.

5 Results:

This section presents the results of our two-step econometric specification. The first step allows us to draw conclusion on the regional intensity of informal competition and to, therefore, compare it between regions of the same country and between countries. The second step shows us to which extent informal competition could affect labor productivity of formal firms. We, then, verify our results using 3 robustness checks tests.

5.A Does regional informal competition matter?

Columns 4 (table 3) reports the indicator of regional informal competition intensity that will be used in the rest of our analysis. This indicator allow us to have global view on the disparity of informal competition intensity in each region included in our sample.

According to the methodology used to construct IRIC as explained in section 4.B, the region Jinja in Uganda is the region of reference that displays the highest IRIC. Column 4 of panel B show that the indicator remain at high levels in other regions of the country, such as in Mbarara, Mbale, Lira and Kampala. Comparing to the reference region, the region Nimba in Liberia displays as the least affected region by the practices of competitors in the informal sector (Column 4 of panel A). This pattern holds in other regions of the same country, such as in Montserrado.

This result mirrors the fact, as the size of the informal sector in both countries is large, but relatively much larger in Uganda. The percentages of employment in the informal sector in Liberia and Uganda indicated in table 1 show that 60% vs. 69.4% persons are in informal employment, 49.5% vs. 59.8% persons are employed in the informal sector and 10% vs. 13.7% persons are in informal employment outside the informal sector). According to the WBES, 31% of the enterprises located in Liberia perceive informal competition as a binding constraint, while 63% of enterprises located in Uganda perceive it as a binding constraint.

Informal firms are usually more concentrated in capital cities and in large cities. It is where they can find the highest level of demand and a large variety of consumers. It is, also, where they can easily hide from state regulation. That is why we can remark that the intensity of informal competition is higher in capital cities, in cities surrounding the capital and in large cities. For example, in Uganda, the intensity of informal competition is higher in the region Jinja comparing to Mbale and Mbarara because Jinja is considered as the third-largest economy in the East African Community. Similarly, in Democratic Republic of Congo, the higher intensity of informal competition is concentrated in the capital city Kinshasa. This is the case also for the capital city Naouakchott in Mauritania, Dakar in Senegal and Maputo in Mozambique.

We can also conclude from our results that the intensity of regional informal competition is high and persistent in the majority of the regions included in the sample. Out of 116 regions, 83 regions show an IRIC higher than 0.5. This result confirms our baseline hypothesis and the reality of most of African and developing countries where informality became the norm.

Moreover, we can remark that the lowest level of IRIC are reported in regions located in Anglophone African countries, such as in Liberia, South Africa and Sierra Leone. This could be related to the fact that Anglophone African countries are more economically dynamic than francophone African countries. They are usually better ranked by the World Bank "doing business" indicators and by the UNDP human development index.

To conclude, our results show that our regional analysis provides interesting results on the prevalence of informal competition. It also emphasize to which extent the effect of informal competition must be analyzed regionally rather than nationally, as suggested by González & Lamanna (2007). Especially that most of initiatives targeting the upgrade of the informal sector are made locally with the help of the local community network and NGOs. This support the importance of constructing a regional indicator of informal competition. In the next section, this indicator will allow us to examine the regional effects of informal competition on labor productivity of formal firms.

Table 3: Indicator of regional informal competition intensity (IRIC)

Panel A: Lowest 15 regions in regional informal competition intensity			
Region	Country	Coefficient	**IRIC**
(1)	(2)	(3)	(4)
Nimba	Liberia	-2.979***	0
Port Elizabeth	South Africa	-2.819***	0.053709
Montserrado	Liberia	-2.210***	0.25814
Kenema	Sierra Leone	-2.035***	0.316885
Free Town	Sierra Leone	-1.905***	0.360524
Mahajanga	Madagascar	-1.842***	0.381672
Abidjan	Ivory Coast	-1.774***	0.404498
Antananarivo	Madagascar	-1.740***	0.415911
Pointe-Noire	Congo	-1.719***	0.422961
Antsiranana	Madagascar	-1.712***	0.425311
Cape Town	South Africa	-1.656***	0.444109
Central Malawi	Malawi	-1.623***	0.455186
Santiago	Capeverde	-1.613***	0.458543
Libreville	Gabon	-1.595***	0.464585
Port-Gentil	Gabon	-1.594***	0.464921
Panel B: Highest 15 regions in regional informal competition intensity			
Central DRC	DRC	-0.565**	0.810339
Kampala	Uganda	-0.560***	0.812017
South DRC	DRC	-0.548***	0.816046
Maputo	Mozambique	-0.524***	0.824102
Pemba	Tanzania	-0.507**	0.829809
Lira	Uganda	-0.478**	0.839543
Nakuru	Kenya	-0.457***	0.846593
Dakar	Senegal	-0.453**	0.847936
Mbale	Uganda	-0.376*	0.873783
Mbarara	Uganda	-0.369*	0.876133
Abia	Nigeria	-0.359*	0.87949
Nouakchott	Mauritania	-0.347**	0.883518
Zanzibar	Tanzania	-0.309*	0.896274
Kinshasa	DRC	-0.280**	0.906009
Jinja	Uganda	0	1

Notes: The regional dummy coefficients are obtained from a probit estimation of the equation (3) using Standardized WBES over the period 2006-2013. The IRIC is the normalized measure of regional informal competition intensity computed as in equation 4. Panel A shows the 15 regions displaying the lowest levels of regional informal competition intensity. Whereas Panel B shows the 15 regions displaying the highest levels of regional informal competition intensity. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

5.B Is it necessary to fear informal competition?

Our benchmark specification (column 1, table 4) shows that the higher is the intensity of local informal competition, the higher is the labor productivity of formal firms. The IRIC coefficients are stable and positive in all specifications (columns 1 to 4). Hence, formal firms seem to have a higher productivity when they face higher local informal competition. A first possible interpretation is that formal firms facing little competition from the informal sector may be protected by regulations – for instance labor regulations or state interventions- and hence do not need to foster their productivity. It is the case of formal large and very productive firms. On the other hand, formal firms subject to more intense informal firms' competition may need to be very productive in order to prevent informal firms from benefiting their cost advantage. It is the case of smaller formal firms. This interpretation is partly in line with the hypothesis of González & Lamanna (2007), assuming that formal firms that resemble informal firms the most are those who fear informal competition the most. They are small, serve the same type of consumers and operate in sectors with low cost of entry. In contrast to González & Lamanna (2007)'s interpretation, we show that those firms are positively affected by informal competition. Hence, we can say that those firms fear something that could actually benefit them, just because informality is considered as a threat.

Another possible interpretation is that formal firms do not distinguish between the sources of competition –whether it is stemmed from informal firms or other formal firms- because they are aware of the importance of the informal sector in their region and sector. Therefore, the behavior of formal firms toward the informal competition is the same as their behavior toward competition stemmed by other formal firms. In both cases, enterprises try to be more efficient and productive in order to increase their competitiveness. This interpretation is in line with the fact that the informal sector became the norm in developing countries. Thus, the difference between informal competition and formal (normal) competition melt away.

Actually, competing against informal firms is not that easy. Our channels of transmission show that informal firms have important characteristics that make them very strong competitors. As informal firms are usually small, they have a managerial innovation capacity in terms of easier communication strategies and more flexible production process. They can easily change their within-firm management and production in response to market shocks. In addition to their advantage in cost, they are able to move where there is the demand. Therefore, formal firms must be aware of these characteristics and find the elements that allow them to boost their productivity and competitiveness.

Our regressions consider some of the most important elements that enhance productivity. All explanatory variable included in our regression take the expected sign and effect except for the age of the firm that is not significantly affecting formal firms' labor productivity (column 1 to 4, table 4). Labor productivity of formal firms increases when firms grow in size, become older, and create a stronger human and financial capital. Unlike female ownership, this positive effect holds when firms have foreign ownership.

The size of the firm is a very important determinant of the performance of the firm and must be taken into consideration when dealing with informal sector practices. Our results show that comparing to

large firms, small and medium-sized firms are less productive. The growth of firms' size enable them to create economy of scale that generates more productivity. As informal firms must remain small to avoid regulation, they are never allowed to create economy of scale. That is why the effect of informal competition is segmented by formal firms' size.

More experienced firms are probably more able to introduce innovation in order to face informal firms' competition. Our results show that the stronger is the experience accumulated by the manager, the highest is the labor productivity of his firm. This effect is both a management quality effect and probably a managerial innovation capacity. In other words, firms with more experienced manager may be able to introduce internal organizational innovations (Brynjolfsson & Hitt, 2003; Duchêne & Russin, 2002).

Furthermore, while firms in developing countries are mainly a "one man show", sole proprietorship appears to have a negative effect on labor productivity of formal firms comparing to other legal forms (partnership, limited partnership and cooperative). These last enable the firm to obtain more financial capital and collaterals that allow them to have easier access to different source of finance, and hence, increase their productivity.

Considering the financial constraint, firms facing more severe obstacles to access source of finance are less productive. More precisely, firms with less access to finance and banking intermediation (access to credit, access to bank accounts) are less productive. Firms with bank accounts or credit line are more productive. As highlighted in several studies, this result confirms the important role of the source of funding in improving the efficiency and productivity of firms (Demirguc-Kunt & Maksimovic, 1998; Beck & Demirguc-Kunt, 2006; Kuntchev et *al.*, 2014; etc.). In complement with the results of Friesen & Wacker (2013), financially constrained formal firms are those who fear informal competition the most. Those firms are not able to easily overcome the advantage in cost that informal firms benefit. Thus, the access to different source of finance is a necessary condition to hold the positive effect of informal competition.

Columns 2 and 3 of table 4, highlight the effects of acquiring an internationally-recognized quality certification and foreign ownership. Quality certification doesn't only refer to ISO certification but it incorporates any internationally recognized quality certification[22]. Foreign ownership refers to any firm that is more than 30% owned by Private foreign individuals, companies or organizations. Both variable can be used as proxy for the capacity of the firm to acquire a new know-how and to innovate. Therefore, firms with quality certification and foreign ownership are expected to have stronger financial and human capital. That is why we find that both variable have a significant positive effect on formal firms' labor productivity. Although the importance of these variables, only 12% of formal firms included in the sample reported acquiring quality certification or foreign ownership.

[22] Some example or internationally-recognized quality certification are given in the WBES note: HACCP (Hazard Analysis and Critical Control Point) for food (especially, but not exclusively, for seafood and juices), and AATCC (American Association of Textiles Chemists and Colorists) for textiles.

The last column of table 4 emphasizes gender-gap effects. When one of the owner of the firm is female, labor productivity of the firm decrease significantly. Because of market gender-discrimination, female-owned firms are always less productive than male-owned firms and they lack experience in dealing with informal firms practices. This fact is highlighted in many studies that focused on the female-owned underperformance hypothesis (Amin, 2011 & 2010; El-Hamidi, 2011, etc.) these studies show that women highly contribute to the prosperity of any economy and that their performing and management strategies could be better than men. However in developing countries their participation is hidden because of the customs and barriers imposed by the family and the market against female work. That is why we find that only 29% of firms in our sample have one of their owners' female.

To summarize our results, we can say that the default hypothesis used by González & Lamanna (2007), Friesen & Wacker (2013) and many other studies on the informal sector should have been verified because the informal sector is not as harmful as they considered it. It is normal to think that formal firms fear informal competition. However, it is too sensitive to assume a priori that informal competition is a threat. Our empirical findings prove that informal competition, analyzed at regional level, affects positively and significantly formal firms' productivity. This positive effect is segmented by formal firms' size, as large and very productive formal firm are already protected. Many elements allow formal firms to benefit more effectively the positive effect of informal competition. Formal firms become more productive and competitive by creating economy of scale, acquiring stronger human and financial capital and by enhancing the expertise of the firm and its managerial capacity.

Table 4: productivity regression:

	Dependent variable : formal firms' log annual labor productivity (US$/employee)			
Variables	Benchmark specification	Quality certification	Foreign ownership	Female ownership
	(1)	(2)	(3)	(4)
IRIC	0.439***	0.408***	0.408***	0.311**
	(0.12)	(0.12)	(0.12)	(0.13)
Firm size: small	0.874***	0.893***	0.919***	0.823***
	(0.08)	(0.08)	(0.08)	(0.08)
Firm size: medium	0.817***	0.828***	0.847***	0.764***
	(0.06)	(0.06)	(0.06)	(0.06)
Firm's age	0.00168	0.00155	0.00179	0.00211
	(0.00)	(0.00)	(0.00)	(0.00)
Manager's year of experience	0.00330**	0.00310**	0.00288**	0.000964
	(0.00)	(0.00)	(0.00)	(0.00)
Sole proprietorship	-0.274***	-0.259***	-0.229***	-0.261***
	(0.03)	(0.03)	(0.03)	(0.03)
Access to finance as an obstacle	-0.112***	-0.111***	-0.103***	-0.103***
	(0.02)	(0.02)	(0.02)	(0.03)
Firm has a line of credit	0.146***	0.152***	0.160***	0.125***
	(0.03)	(0.03)	(0.03)	(0.03)
Firm has a checking or saving account	0.308***	0.300***	0.295***	0.241***
	(0.03)	(0.03)	(0.03)	(0.04)
Quality certification		0.169***	0.149***	0.167***
		(0.04)	(0.04)	(0.05)
Foreign ownership			0.215***	0.249***
			(0.02)	(0.03)
Female ownership				-0.0826***
				(0.03)
Country dummy	yes	yes	yes	yes
Year dummy	yes	yes	yes	yes
Industry dummy	yes	yes	yes	yes
Constant	7.651***	4.336***	4.278***	4.495***
	(0.53)	(0.30)	(0.30)	(0.35)
Observations	8,900	8,734	8,734	7,013
R-squared	0.311	0.313	0.316	0.344
Level of se clustering	Sector	Sector	Sector	Sector

Notes: The dependent variables is the log of annual labor productivity of formal firms reported in US $ and computed as the ratio of last fiscal year total sales revenues in US dollar over last fiscal year total full time permanent, temporary and seasonal workers. IRIC is the indicator of regional informal competition intensity, our explanatory variable of interest showing the intensity of informal competition in each region included in the sample. Dummies for firms' size are included taking the size "large" as a reference. Log firm age is the logged difference between the date of the interview and the date the firm began operation (plus one). Manager years of experience is a continuous variable showing the number of years the firm's manager has in the sector. Sole proprietorship is a dummy variable taking 1 if the status of the firm is sole proprietorship and zero otherwise. Access to finance is a dummy variables taking 1 if the firm perceives access to finance as binding constraint to the current operation of the firm and zero otherwise. Firm has a saving or checking account, line of credit are dummy variables taking 1 if the firm has a saving or checking account, a line of credit and zero otherwise. Quality certification is a dummy variable taking 1 if the firm has an internationally-recognized quality certification and zero otherwise. Foreign ownership is a dummy variable taking 1 if foreign ownership of the firm exceed 30% and zero otherwise. Female ownership is a dummy variable taking 1 if one of the firm's owner is female and zero otherwise. Industry dummies are a set of dummies for each industry included in the survey. The reference industry is retail and wholesale trade. Year dummies are a set of dummies indicating the year in which the survey was conducted in each country. The reference year is 2007. Country dummies are a set of dummies for each country included in the sample. The reference country is Nigeria. Standard errors reported in brackets are robust and clustered by industry. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

5.C Robustness checks:

5.C.a Bootstrap resampling methodology:

As our regional indicator of informal competition intensity is estimated from a preliminary specification, we account for the importance of computing an adjustment to the common variance matrix estimate that controls for the variability in the estimated coefficients of the generated regressor. That is why applying the bootstrapping resampling method is necessary. Similarly, we also must account for industry level clusters. Due to the limited number of identified clusters, we are not able to perform both commands at one time. However, since the results are very similar we keep the industry level clusters as our main specification. We, then, report the results with bootstrap sampling and estimates as our first robustness check.

Column 5 of table 5.a reports the results of the bootstrap resampling methodology with 2000 replication. The generated non-parametric robust standard error are almost the same as generated by the benchmark specification. The coefficient of the regional informal competition intensity remain positive and significant. Similarly for all other variable included in the regression that take the same sign and significance. Therefore, our underlined interpretations are still valid with the bootstrap resampling methodology.

5.C.b Truthful and reliable information:

Despite the importance of micro-level data in drawing useful policy implication, the credibility of collected data is usually criticized. Most of the data provided by micro-level surveys rely on subjective perceptions and opinions of the respondent. In the WBES, question on perception regarding business environment are administered to the managing director or the direct representative of the firm. While, question on production costs, investment flows and statistics can be administrated to the managing director, the accounting department, the bookkeeper and/or the human resource manager. Provided figures can be taken directly from the firms' record (if any) or estimated with precision. In addition, efforts are made by enumerators to assure respondents of the confidentiality of their information.

However, some respondent can be reluctant in providing such sensitive information. That is why enumerators are asked to confirm the credibility of provided information by answering 2 questions:

- It is my perception that the questions regarding opinions and perceptions:
    1. Truthful
    2. Somewhat truthful
    3. Not truthful
- The questions regarding figures (productivity and employment numbers):
    1. Are taken directly from establishment records
    2. Are estimates computed with some precision
    3. Are arbitrary and unreliable numbers

Columns 6, 7 and 8 of table 5.a report the results of our benchmark regression after dropping alternatively untruthful opinions and perception (answer no.3), untruthful and somewhat truthful

opinion and perception (answer no.2 and 3), then arbitrary & unreliable numbers (answer no.3 of each question). We can see that our regional indicator of informal competition remain positive and highly significant, expect in column 7 where the significance is reduced to 10%. All other explanatory variables keep the same sign and significance as in the benchmark specification.

Table 5.a: robustness checks: Bootstrap methodology and credibility of information:

	Dependent variable : formal firms' log annual labor productivity (US$/employee)				
Variables	Benchmark specification	Bootstrap resampling methodology	Truthful and somewhat truthful Opinion and perceptions	Only truthful Opinion and perceptions	Reliable figures
	(1)	(5)	(6)	(7)	(8)
IRIC	0.439***	0.439***	0.461***	0.284*	0.506***
	(0.12)	(0.16)	(0.12)	(0.14)	(0.12)
Firm size: small	0.874***	0.874***	0.881***	0.788***	0.895***
	(0.08)	(0.06)	(0.08)	(0.08)	(0.08)
Firm size: medium	0.817***	0.817***	0.826***	0.748***	0.839***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Firm's age	0.00168	0.00168	0.00151	0.00	0.00164
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Manager's year of experience	0.00330**	0.00330**	0.00333**	0.00386**	0.00285**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sole proprietorship	-0.274***	-0.274***	-0.272***	-0.286***	-0.273***
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
Access to finance as an obstacle	-0.112***	-0.112***	-0.112***	-0.116***	-0.115***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)
Firm has a line of credit	0.146***	0.146***	0.146***	0.118**	0.146***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Firm has a checking or saving account	0.308***	0.308***	0.311***	0.301***	0.314***
	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)
Dummy country	yes	yes	yes	yes	yes
Dummy sector	yes	yes	yes	yes	yes
Dummy year	yes	yes	yes	yes	yes
Constant	7.651***	7.651***	7.639***	8.040***	7.939***
	(0.53)	(0.55)	(0.53)	(1.05)	(0.64)
Observations	8,900	8,900	8,853	5,672	8,653
R-squared	0.311	0.311	0.311	0.329	0.313
Level of se clustering	sector		sector	sector	sector

Note: this table recall the benchmark specification (see notes table 4). Table (5): Non-parametric robust bootstrapped standard errors (2000 replications) are reported in brackets. Table (6): only truthful opinions and perceptions are considered. Table (7): only reliable figures (taken directly from firms' records, estimated with precision) are considered. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

5.C.c Total factor productivity measure (TFP):

As already mentioned, we reflect formal firms' performance in our benchmark regression using formal firms' labor productivity. Data required to measure total factor productivity –such as cost of capital and labor- are available for a very limited number of firms in our sample. In this section, we use this subset of firms to compute TFP in order to verify the validity of our results.

As done by Bloom et *al.* (2010)[23], we consider the following Cobb Douglas firm level production function

$$y_{ij} = \propto_l l_{ij} + \propto_e e_{ij} + \propto_q q_{ij} + \beta IRIC_{ij} + \gamma' Z_{ij} + u_{ij}$$

Where y_i= last fiscal year total annual sales in US$, l_i= total labor costs last fiscal year in US$ including wages, salaries and bonus, e_i= total annual cost of electricity in last fiscal year in US$, q_i=total annual expenditure for purchase of equipment in last fiscal year in US$ of firm *i* in country *j*. Lower case letters denote natural logarithms. Vector Z consists of a number of control variable that affect productivity, such as firms' age, manager's year of experience, firms' legal status, financial constraints and a set of country, industry and year dummies.

Our coefficient if interest is the coefficient β that will verify the effect of the indicator of regional informal competition *IRIC* using TFP measure instead of labor productivity. Column 9 of table 5.b, show that IRIC remain positive and highly significant at 1%. Therefore, our result is still valid even with a subset of firms for which we can measure TFP (almost 5800 firms).

Table 5.b: robustness checks: total factor productivity and informal competition:

Variables	Benchmark specification	Dependent variable: log total annual sales in US$ (last fiscal year)
	(1)	(9)
log(labor cost)		0.695***
		(0.02)
log(electricity cost)		0.0464***
		(0.01)
log(Equipment cost)		0.00397**
		(0.00)
IRIC	0.439***	0.354***
	(0.12)	(0.09)
Firm's age	0.00168	0.00231
	(0.00)	(0.00)
Manager's year of experience	0.00330**	-0.00153
	(0.00)	(0.00)
Sole proprietorship	-0.274***	-0.151***
	(0.03)	(0.03)
Access to finance as an obstacle	-0.112***	-0.124***
	(0.02)	(0.02)
Firm has a line of credit	0.146***	0.0406
	(0.03)	(0.03)
Firm has a checking or saving account	0.308***	0.187***
	(0.03)	(0.04)
Firm size: small	0.874***	
	(0.08)	
Firm size: medium	0.817***	
	(0.06)	
Dummy country	yes	yes

[23] In Bloom et *al.* (2010)'s paper, they use a similar equation to test the effect of modern management practices on manufacturing firms productivity in UK .

Dummy sector	yes	yes
Dummy year	yes	yes
Constant	7.651*** (0.53)	4.607*** (0.12)
Observations	8,900	5,794
R-squared	0.311	0.664
level of se clustering	sector	sector

Notes: this table recall the benchmark specification (see notes table 4). Table (9): the dependent variables is the log of last fiscal year total annual sales in US$. All costs are reported in US$. Cost of labor includes wages, salaries and bonus, etc. Standard errors reported in brackets are clustered by industry. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

6 Business environment associated with informal competition:

Our benchmark regression proved empirically that regional informal competition could significantly and positively affect formal firms' labor productivity. In this section, we investigate to which extent business environment can affect the positive effect associated with informal competition.

Using the World Bank Worldwide governance indicators (WGI), we account for four different business environment's characteristics[24]:

- Control of corruption (COR): *captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.*
- Rule of law (RULE): *captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.*
- Governance effectiveness (GOV): *captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.*
- Regulatory quality (REG): *captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development*

The scale of these indicators are approximately running from -2.5 to 2.5 scale. To produce easier interpretation of the results, we normalize them in order to create indicators that range between 0 and 1, Where 0 correspond to lower ranks and 1 correspond to higher ranks. Then, we alternatively introduce these indicator in our benchmark regression interacted with our variable of interest IRIC, as shown by the following equation:

$$lprod_{ij} = \alpha_0 + \alpha_1 IRIC_{ikj} * WGI + \alpha_2 Z + \theta_t + \theta_s + \theta_c + \varepsilon_{ij}$$

[24] The definition of each indicator is taken from the WGI's website: http://info.worldbank.org/governance/wgi/index.aspx#home

Where $lprod_{ij}$ is the logged annual labor productivity of the formal firm *i* of country *j* in US $. $IRIC_{ikj}$ is the constructed indicator of regional informal competition intensity that varies across firms *i* operating in regions *k* of country *j*. WGI reflects the four indicator that we introduce alternatively in the regression. Z is the set of control variables including firm control variables such as the size of the firm, its age, its legal status, the characteristics of the owner and the different obstacle faced by the firm. We also control for unobserved year-specific (θ_t), industry-specific (θ_s) and country-specific (θ_c) factors that might affect our dependent variable

The results of these regressions are reported in table 6. We can first remark that the effect of regional informal competition remain positive and highly significant at the 1% level. Comparing to our benchmark specification, all other variables keep the same sign and significance levels. This confirm again the validity of our main results and interpretations.

Considering for the direct effects of our four measure of business environments, we notice that the indicators of control of corruption and rule of law insignificantly affect labor productivity of formal firms. However, the indicators of government effectiveness and regulatory quality are significant and affect negatively formal firms' labor productivity. This result is puzzling because better control of corruption and more effective governance, rule of law and regulatory quality are expected to have significant and positive impact on firms' productivity. This unexpected result is explained relying on the level of WDI and doing business indicator that remain at the lowest level in Sub-Saharan Africa comparing to all other regions and countries of the world. Therefore, even if the level of one of these indicators is enhancing, the lack of the others may put at risk its efficiency.

Considering for the interacted effects, we observe that the four interaction of IRIC with WDI have a negative sign and are highly significant. This result means that the IRIC has a positive effect on formal firms' labor productivity, but this positive effect is reduced by the introduction of new policies that target the enhancement of the business environment. As already mentioned, the informal sector is considered by default as a threat. That is why all undertaken policies to enhance the business environment of formal firms are repressive policies for the informal sector. Therefore, these policies are susceptible to jeopardize any positive effects linked to the informal sector, even if they are ineffectively undertaken.

Table 6: IRIC and business environment:

Variables	Dependent variable : formal firms' log annual labor productivity (US$/employee)				
	Benchmark specification	Interactions with IRIC			
		COR	RULE	GOV	REG
	(1)	(10)	(11)	(12)	(13)
IRIC	0.439***	1.066***	1.221***	0.983***	1.532***
	(0.12)	(0.28)	(0.33)	(0.24)	(0.32)
Firm size: small	0.874***	0.877***	0.879***	0.865***	0.864***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Firm size: medium	0.817***	0.819***	0.821***	0.810***	0.813***
	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)
Firm's age	0.00168	0.00173	0.00173	0.0016	0.00159
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Manager's year of experience	0.00330**	0.00332**	0.00314**	0.00351**	0.00312**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sole proprietorship	-0.274***	-0.275***	-0.274***	-0.281***	-0.282***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Access to finance as an obstacle	-0.112***	-0.113***	-0.111***	-0.117***	-0.110***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Firm has a line of credit	0.146***	0.146***	0.147***	0.146***	0.146***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Firm has a checking or saving account	0.308***	0.311***	0.309***	0.310***	0.305***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
COR		1.104			
		(0.85)			
IRIC# COR		-1.862**			
		(0.65)			
RULE			2.108		
			(1.55)		
IRIC# RULE			-1.596**		
			(0.69)		
GOV				-1.687**	
				(0.61)	
IRIC#GOV				-1.191***	
				(0.37)	
REG					-3.393***
					(0.99)
IRIC# REG					-1.846***
					(0.53)
dummy country	yes	yes	yes	yes	yes
dummy sector	yes	yes	yes	yes	yes
dummy year	yes	yes	yes	yes	yes
Constant	7.651***	3.863***	3.953***	3.935***	2.878***
	(0.53)	(0.31)	(0.37)	(0.34)	(0.51)
Observations	8,900	8,900	8,900	8,900	8,900
R-squared	0.311	0.311	0.311	0.314	0.314
level of se clustering	sector	sector	sector	sector	sector

Notes: this table recall the benchmark specification (see notes table 4). columns 10, 11, 12 and 13 include Worldwide governance indicators. COR stands for the indicator of control of corruption. RULE stands for the indicator of rule of law. GOV stands for the indicator of governance effectiveness. REG stands for the indicator of regulatory quality.

7 Conclusion:

This paper investigates the effect of competition stemmed by informal enterprises on the labor productivity of formal firms in 31 Sub-Saharan African countries. We update the two-step methodology of Guiso et *al.* (2004) to construct a regional indicator of informal competition intensity using a pooled sample of 14437 formal firms extracted from the standardized World Bank Enterprise Survey over the period 2006-2013. We, then, estimate the effect of our constructed indicator on the labor productivity of formal firms included in our sample.

The standardized Enterprise Surveys remain very useful and provide unique information comparable across the world's economies. Yet, the existence of endogeneity might occur because of the causal relationship existing between the intensity of informal competition perceived by each formal firm and their labor productivity. We try to partly eliminate the endogeneity issue, using our constructed local indicator of informal competition intensity that differs across the regions of each country and that remains constant when comparing firms located in the same region. We also involve industry, country and year fixed effects to prevent any omitted variable bias or model specification. Moreover, multiple checks are implemented to verify our main results.

As expected, we find that the intensity of regional informal competition is high and persistent in the majority of the regions included in the sample, and it widely differs across regions of the same country and across countries. These results show to which extent regional informal competition matters and confirm our baseline hypothesis assuming that the effect of informal competition must be analyzed regionally rather than nationally.

Unlike the majority of studies focusing on the informal sector, we conclude that the presence of informal firms is not as harmful as it is considered. Our results show that more intense competition stemmed by informal enterprises drives formal firms to be more productive. Informal firms' cost advantage pushes formal firms to be more productive and more competitive. Many elements allow formal firms to benefit more effectively the positive effect of informal competition. Formal firms become more productive and competitive by creating economy of scale, acquiring stronger human and financial capital and by enhancing the expertise of the firm and its managerial capacity.

Our results allow us to draw some interesting policy implications. We find evidence on the weaknesses o Sub-Saharan African's business environment. We also confirm that undertaken policies to enhance the business environment of formal firms are repressive policies for the informal sector. Therefore, these policies are susceptible to jeopardize any positive effects linked to the informal sector, even if they are ineffectively undertaken. That is why, the findings of this paper suggest that these countries must recognize the importance of informal firms and integrate them in their policies to improve their role. To do so, they must ensure the creation of a secured business environment, not only for formal firms, but also for informal ones that remain a very important part of the production system in developing counties. They may also consider the fact that formalizing the informal sector depends on the willingness of Governments and not only on that of informal firms who may prefer to remain informal.

Finally, our results show to which extent the informal sector could be considered as an economic resource in developing economies. The positive effect of regional informal competition on formal firms' productivity can be a good explanation for the decrease in African poverty and the increase in African growth. Even if this form of competition is generated from firms that do not comply with any government regulations or laws, the informal sector will remain the first source of revenue for poor (rather unemployed, or underemployed) and will encourage formal firms to foster their productivity. That is why our results stress the necessity of reconsidering the importance of the informal sector in the developing world.

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Appendices:

Appendix 1: List of countries

	Country	#Enterprises per country	% Enterprises per country	#Regions per country	Survey Year	World Bank income classification-July 2014
1	Angola	627	4.34	3	2006-2010	UM
2	Botswana	406	2.81	2	2006-2010	UM
3	Burkina-Faso	269	1.86	2	2009	L
4	Cameroun	261	1.81	3	2009	LM
5	Cape Verde	92	0.64	3	2009	LM
6	Congo	86	0.6	2	2009	LM
7	Cote d'Ivoire	311	2.15	2	2009	LM
8	DRC	1,031	7.14	8	2006-2010-2013	L
9	Ethiopia	492	3.41	4	2011	L
10	Gabon	93	0.64	2	2009	UM
11	Gambia	160	1.11	2	2006	L
12	Ghana	618	4.28	4	2007-2013	LM
13	Guinea	217	1.5	2	2006	L
14	Kenya	891	6.17	6	2007-2013	LM
15	Liberia	101	0.7	2	2009	L
16	Madagascar	790	5.47	11	2009-2013	L
17	Malawi	81	0.56	2	2009	L
18	Mali	736	5.1	4	2007-2010	L
19	Mauritania	215	1.49	2	2006	LM
20	Mozambique	418	2.9	4	2007	L
21	Namibia	254	1.76	2	2006	UM
22	Nigeria	1,795	12.43	11	2007	LM
23	Rwanda	353	2.45	2	2006-2011	L
24	Senegal	458	3.17	4	2007	LM
25	Sierra Leone	134	0.93	2	2009	L
26	South Africa	493	3.41	4	2007	UM
27	Swaziland	259	1.79	3	2006	LM
28	Tanzania	1,010	7	6	2006-2013	L
29	Uganda	1,141	7.9	6	2006-2013	L
30	Zambia	63	0.44	2	2007-2013	LM
31	Zimbabwe	582	4.03	4	2011	L
	Total	14437	100	116		

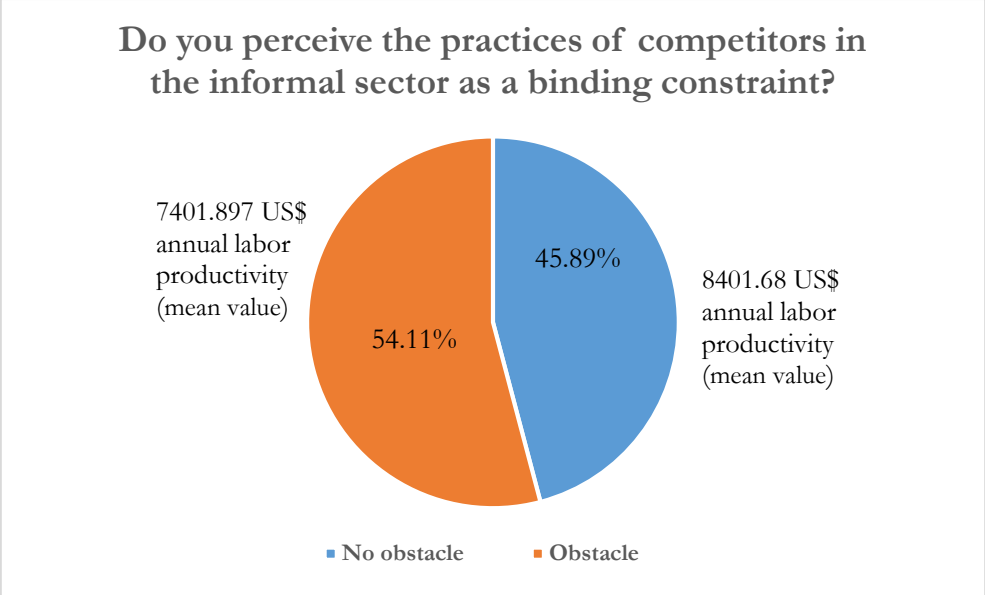
Source: World Bank Enterprise Survey, standardized dataset. http://www.enterprisesurveys.org

Appendix 2: Summary statistics of main variables

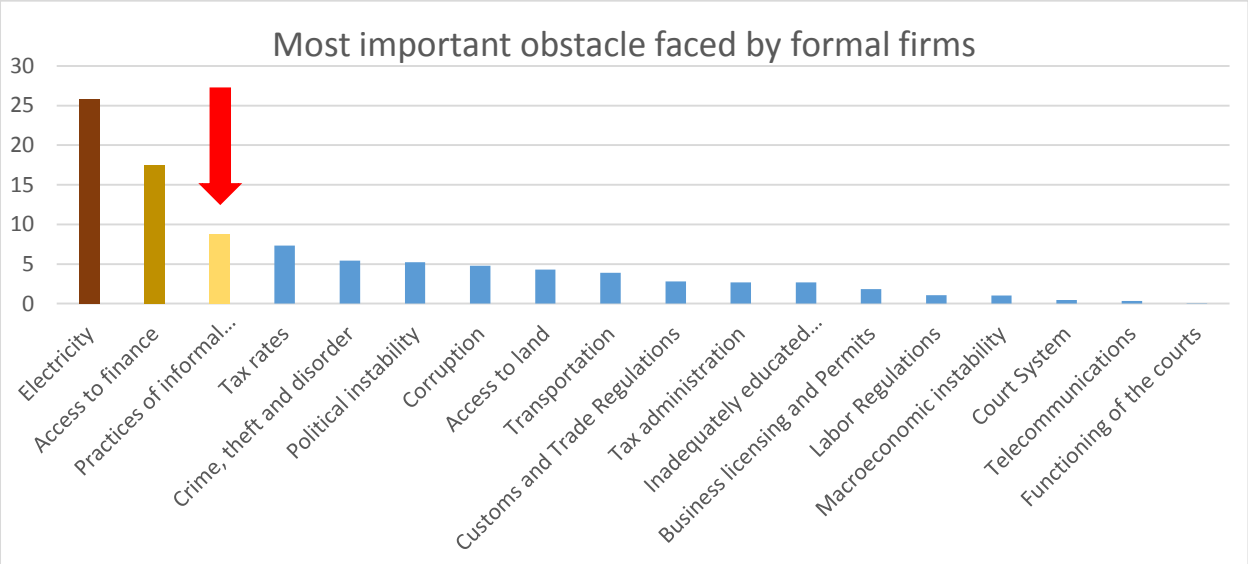
Variable	Obs.	Mean	Std. Dev.	Min	Max
a) Annual labor productivity in US $	11450	7823.224	8216.161	237.1735	38554.74
b) Annual sales revenue in US $ (output)	12811	151462.3	208248.4	0	999722.4
c) Total full time workers (labor=permanent, temporary and seasonal workers)	14247	29.0301	95.80393	5	3669
d) Firm age	14169	13.05496	12.40526	0.01	172.01
e) Manager's years of experience in the sector	14131	12.62991	9.062227	0.01	90.01
f) Labor costs	12547	97490.65	4500312	4.53E-06	4.77E+08
g) Electricity costs	12353	8667.787	164477.5	1.94E-06	1.20E+07
h) Equipment costs	8303	262626.8	1.34E+07	1.94E-06	1.09E+09

	Freq.	Percent	Average annual labor productivity
i) Size of the firm			
Small(<20)	10,118	70.08	7843.774
Medium(20-99)	3,611	25.01	8393.617
Large(100 and over)	708	4.9	2788.703
Total	14437	100	
j) Sector of activity			
Textiles	289	2	6083.828
Leather	136	0.94	9286.42
Garments	1,156	8.01	5240.471
Food	1,750	12.12	8048.518
Metals and machinery	767	5.31	7193.002
Chemicals and pharmaceuticals	256	1.77	9618.454
Wood and furniture	458	3.17	5229.007
Non-metallic and plastic materials	307	2.13	8137.184
Other manufacturing	1,810	12.54	8360.354
Retail and wholesale trade	3,777	26.16	9496.247
Hotels and restaurants	1,384	9.59	6321.171
Other services	1,700	11.78	6954.059
Other: Construction, Transportation, et	647	4.48	8428.211
Total	14437	100	
k) Firms with sole proprietorship	8,828	61.15	6803.432
l) Firms with partnership legal status	2425	16.79	8685.827

m) Formal firms' perceptions towards the practices of competitors in the informal sector:



n) Most important constraints faced by formal firms in their operation:



Note: all figures are computed by the authors.
Source: World Bank Enterprise Survey, standardized dataset. http://www.enterprisesurveys.org

Appendix 4: List of variables

	Variable name	Variable type	Source
1	**Annual labor productivity in US $ (in log)** = Total last fiscal year sales revenue in US $ / total full time permanent, temporary and seasonal workers (temporary and seasonal workers are weighted by their average length of employment).	Continuous variable	Computed
2	**Total last fiscal year sales revenue in US $** *Question D2: In fiscal year [insert last complete fiscal year], what were this establishment's total annual sales?*	Continuous variable	ES*
3	**Total full time permanent, temporary and seasonal workers** *Question L1: At the end of fiscal year [insert last complete fiscal year], how many permanent, full-time employees did this establishment employ?* *Question L6: How many full-time temporary employees did this establishment employ in fiscal year [insert last complete fiscal year]?* *Question L8: What was the average length of employment of all full-time temporary employees in fiscal year [insert last complete fiscal year]?*	Continuous variable	ES
4	**Period average official exchange rates** for each country specified in the model	Continuous variable	World Development Indicators and the international monetary fund
5	**Formal firms' perception on informal competition** *Questions E30: Do you think that the practices of competitors in the informal sector are No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?*	Discrete variable: No obstacle/ Minor / Moderate/ Major/ Very severe obstacle (used as dummy variable =1 if informal competition is perceived as binding constraint and 0= otherwise)	
6	**Firms' size** *Question A6: what is the size of the firm?*	Discrete variable: Small/ Medium/ Large	ES
7	**Sector of activity** *Question A4: Industry*	Discrete variable: Textiles/Leather/Other: Construction, Transportation, etc./Other manufacturing/Metals and machinery/Food/Chemicals and pharmaceuticals/Other services/Retail and wholesale trade/Garments/Electronics/Non-metallic and plastic materials/Hotels and restaurants/Wood and furniture	ES

8	**Firm's age** = year of the interview-year the firm began operation (plus one) *Question B5: In what year did this establishment begin operations in this country?*	Continuous variable	ES
9	**Sole proprietorship** *Question B1: What is this firm's current legal status?*	Dummy variable=1 if sole proprietorship, 0=otherwise (Publicly listed company/ privately held/Partnership/ limited partnership)	ES
10	**Manager's year of experience** *Question B7: How many years of experience working in this sector does the top manager have?*	Continuous variable	ES
11	**Formal firms' perception on access to finance** *Question K30: Is access to financing, which includes availability and cost [interest rates, fees and collateral requirements], No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?*	Discrete variable: No obstacle/ Minor / Moderate/ Major/ Very severe obstacle (used as dummy variable =1 if access to finance is perceived as binding constraint and 0= otherwise)	ES
12	**Access to source of finance** *Question K6: At this time, does this establishment have a checking and/or saving account?*	Dummy variable =1 if yes, 0=no	ES
13	**Access to source of finance** *Question At this time, does this establishment have a line of credit or loan from a financial institution?*	Dummy variable =1 if yes, 0=no	ES
15	**Crime** *Question I3: In fiscal year [insert last complete fiscal year], has this establishment experienced losses as a result of theft, robbery, vandalism or arson?*	Dummy variable =1 if yes, 0=no	ES
19	**Tax rates** *Question J30a: Are tax rates No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?*	Discrete variable: No obstacle/ Minor / Moderate/ Major/ Very severe obstacle (used as dummy variable =1 if labor regulation is perceived as binding constraint and 0= otherwise)	ES
16	**Licensing** *Question J30c: Are Business licensing and permits No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?*	Discrete variable: No obstacle/ Minor / Moderate/ Major/ Very severe obstacle (used as dummy variable =1 if labor regulation is perceived as binding constraint and 0= otherwise)	ES
17	**Corruption** *Question J30f: Are corruption No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?*	Discrete variable: No obstacle/ Minor / Moderate/ Major/ Very severe obstacle (used as dummy variable =1 if labor regulation is perceived as binding constraint and 0= otherwise)	ES
18	**Regions** *Question A3: City/town/village*	Discrete variable	ES

19	**Country** *Question A1: Country*	Discrete variable	ES
20	**Quality certification** *Question B8: Does this establishment have an internationally-recognized quality certification?*	Dummy variable =1 if yes, 0=no	ES
21	**Foreign ownership** *Question B2b: what percent of this firm is owned by private foreign individuals, companies or organizations?*	Dummy variable =1 if foreign ownership exceed 30%, 0=otherwise	ES
22	**Female ownership** *Question B4: are any of the owners female?*	Dummy variable =1 if yes, 0=no	ES
23	**Labor cost in US$ in (log)** *Question n2a: what are the total labor costs in last fiscal year, including wages, salaries and bonus?*	Continuous variable	ES
24	**Electricity costs in US$ (in log)** *Question n2b: what are the total annual costs of electricity in last fiscal year?*	Continuous variable	ES
25	**Equipment costs in US$ (in log)** *Question n5a: what are the total annual expenditure for purchase of equipment in last fiscal year?*	Continuous variable	ES
26	**Control of corruption (COR)** *Captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.*	0-1 indicator	World Bank Worldwide Governance Indicators
27	**Rule of law (RULE)** *Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.*	0-1 indicator	World Bank Worldwide Governance Indicators
28	**Governance effectiveness (GOV)** *Captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.*	0-1 indicator	World Bank Worldwide Governance Indicators
29	**Regulatory quality (REG**) *Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development*	0-1 indicator	World Bank Worldwide Governance Indicators

*ES: Standardized WBES Core module

Source: World Bank Enterprise Survey, standardized dataset. http://www.enterprisesurveys.org